In re Application of: Noam EGOZI
Serial No.: 10/526,428
Filed: February 28, 2005
Office Action Mailing Date: December 14, 2010

Examiner: Sanjay CATTUNGAL
Group Art Unit: 3768
Attorney Docket: **39878**
Confirmation No.: 5344

REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1 - 73 are in this Application. Claims 18 – 38, 41, 43, 47 – 48, 51 – 52, 59 – 70, and 72 - 73 have been withdrawn from consideration. Claims 1 – 5, 8 – 14, 17, 39, 40, 44, 49, 50, 53 – 58, 65, and 71, have been rejected under 35 U.S.C. *§* 102. Claims 6, 7, 15, 16, 45, and 46, have been rejected under 35 U.S.C. § 103. Claim 42 has been canceled in a previous response. Claims 1, 43 and 53 have been amended herewith.

The Examiner is respectfully made aware that the US Patent Application Publication, to Egozi, having Pub. No. US 2006/0020208 A1, and Pub. Date: Jan. 26, 2006, of the present U.S. Patent Application No. 10/526,428, was used for preparing the present Response. Accordingly, Applicant's references to page and paragraph numbers correspond to those of the just stated publication of the present patent application document.

Amendments To The Claims

Claims 1 and 53 were amended for clarifying that the transmitted and detected signals are electromagnetic signals. Support may be found in Egozi, page 1, paragraph [0005].

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35 U.S.C. § 102 Rejections

Regarding Claims 1, 44 and claim 53:

Claims 1, 44 and 53 were rejected by the Examiner under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,699,191 to Brock-Fisher. The Examiner states in the rejection:

"Regarding claims 1, 44, and 53, Brock teaches a method of detecting gas bubbles in a living body, comprising: transmitting at least one original electromagnetic signal to body portion (figs. 2 and 3; abstract and col. 2 lines 10 – 24); detecting a signal modulated by a flow of blood in said body portion (figs. 2 and 3; abstract and col. 2 lines 10 – 24); and analyzing a perturbation in said signal to determine at least one of an existence and a property of a bubble in said signal to determine at least one of an existence and a property of a bubble in said blood flow (figs. 2 and 3; abstract and col. 2 lines 10 – 24) wherein said transmitting, said detecting and said analyzing are carried out by a device worn on said body."

The Applicant respectfully disagrees with the Examiner as to the teachings of Egozi being anticipated by Brock-Fisher. Brock-Fisher does not teach transmitting and detecting an electromagnetic signal as taught by Egozi, **or** analyzing perturbations in the detected signal. Brock-Fisher specifically teaches transmitting and detecting an ultrasound signal (which is clearly not an electromagnetic signal rather an acoustic signal) and analyzing the amplitude of the second harmonic in the detected acoustic signal for identifying gas bubbles. Brock-Fisher describe, as is known in the art, exciting the gas bubbles into resonance by the use of acoustic pressure (ultrasound), and analyzing the second harmonic of the resonant frequency of the bubbles. Brock-Fisher's use ultrasound as is repeatedly disclosed in their patent and as quoted by the

Examiner in the office action (abstract and col. 2 lines 10 – 24), and make no mention anywhere regarding use of electromagnetic signals. Furthermore, Brock-Fisher cannot use electromagnetic signals as the signals are not useful for exciting the gas bubbles into resonance (acoustic pressure is required). Figure 2 cited by the Examiner clearly shows a harmonic filter (36) for filtering out the second harmonics for analyzing by the detection controller (30). Reference is made to Brock-Fisher, column 8, lines 13 – 23, wherein is taught analyzing the second harmonics of the detected signal, and not analyzing of perturbations:

"In case of using a second harmonics microbubble detection technique, a harmonic filter **36** filters out second harmonic preferentially and provides the second harmonic to the controller **30** for bubble presence analysis. Alternatively, it may be preferential to employ the harmonic filter **36** as an analog filter ahead of the A/D converter and filter **42** . Therefore, the present invention provides a device that uses a non-linear bubble detection technique to detect the presence of naturally occurring microbubbles in bloodstream of an underwater diver during the diver's ascent (i.e., detect blood stream microbubbles caused by caisson's disease)."

Brock-Fisher makes reference to other ultrasound contrast agent (UCA) methods known in the art (U.S. Patents No. 5,706,819; 5,577,505; 5,632,277; 5,902,243; and 5,980,459) but again, all methods teach transmitting and detecting an ultrasound signal and not electromagnetic signals. Furthermore, all methods teach analyzing second harmonics in the reflected (detected) wave but do not teach analyzing perturbations in the detected wave.

Therefore, based on the above explanation, the Applicant respectfully requests from the Examiner to allow claims 1 (currently amended), 44, and 53 (currently amended), under 35 U.S.C. 102(e).

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Regarding claims 2 – 5, 8 – 14, 17, 39, 40, 49, 50, 54 – 58, 65, and 71:

The Applicant respectfully requests from the Examiner to overturn the rejections of dependent claims 2 – 5, 8 – 14, 17, 39, 40, 49, 50, 54 – 58, 65, and 71, depending from patentable independent claims 1, 44, and 53, respectively.

35 U.S.C. § 103 Rejections

Regarding dependent claims 6 and 7:

Dependent claim 6 (claim 7) was rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,699,191 to Brock-Fisher in view of U.S. Patent No. 5,394,732 to Johnson et al. The Examiner states in the rejection that "Brock teaches all of the above claimed limitations but does not expressly teach that the signal is visible light (infrared light). Johnson teaches visible light (infrared light) to detect bubbles in blood (col. 5, lines 7 – 12). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Brock to use visible light (infrared light) as the signal as taught by Johnson, since the different signal types (visible light, ultrasound, ultraviolet, infrared, or rf energy) are capable of being processed in a similar way to yield a similar result, as such the different signals are obvious variants of each other.

The Applicant respectfully disagrees with the Examiner as to the teachings of Egozi being unpatentable over Brock-Fisher in view of Johnson et al. As previously discussed, Brock-Fisher (including the art cited therein) detects gas bubbles by

transmitting an acoustic signal (ultrasound) to a fluid and exciting the gas bubbles into resonance. The second harmonic of the resonant frequency of the gas bubbles is detected in the reflected signal and analyzed. Applying an electromagnetic signal to the gas bubbles will not excite them into resonance, so that the second harmonic cannot be detected and analyzed.

Johnson utilizes a completely different approach for detecting bubbles in blood by transmitting an ultrasound signal through the blood and measuring the attenuation in the signal as it passes through the blood, attributing this attenuation to bubbles in the blood. Johnson et al. can use light and infrared as the attenuation is measured as a function of the bubble blocking the transmission of a portion of the signal, but again, no resonating excitation is applied. Furthermore, Johnson et al. disclose that the degree of attenuation is a measure of the size of the bubble. Reference is made to Johnson et al., column 5, lines 52 – 62 and column 6, lines 1 -2:

"When an air bubble passes through the detection area, some of the sound is absorbed and causes a reduction or attenuation of level of sound detected by the receiving transducer 44. The received signal 48 is related to the bubble size. The bubble detector circuit 30 receives the received signal 48 from the receiving transducer 44 in inverse proportion to the air in the blood 36.

The bubbles cause reductions in the received signal 48 that range from about 5%, for very small bubbles, to almost 100% for much larger bubbles. Bubbles larger than about 8 microliters (μL) in volume (2.5 millimeters (mm) in diameter) block a substantial portion of the signal from reaching the receiving transducer 44. Small bubbles of about 1 μL in volume (0.58 mm diameter) produce ultrasound signals that correspond to about 12% of the normal quiescent ultrasonic signal. When no tube 34 is in place, or when the tube 34 is not filled with fluid 36, virtually no ultrasonic signal is received."

As stated by the Examiner, Johnson et al. discloses the use of other signals, including light and infrared. It would seem apparent to an ordinary person skilled in the art practicing Brock-Fisher's invention to analyze the second harmonics of the reflected transmitted light or infrared signals. Nevertheless, neither Brock-Fisher nor the art cited therein which include 5 U.S. Patents, make any mention of light or infrared, or the use of the second harmonics of these electromagnetic waves, for detecting the gas bubbles in the blood. This suggests that Brock-Fisher's teachings are not suitable for use with light or infrared (or other electromagnetic signals) as the bubbles cannot be excited into resonance.

The Applicant further wishes to call the Examiner's attention to Johnson's teaching away from Egozi by using invasive measures to extract blood from a patient into a tube outside of the body where the detection is performed, and not by transmitting the signals into a body portion (non-invasively) as taught by Egozi. Reference is made to Johnson, column 5, lines 23 – 41:

"The UABD 22 incorporates a bubble detector circuit 30 and a tubing holder 32 for transmitting and receiving an ultrasonic signal through a tube 34 through which blood 36 is flowing. The tube 34 is typically flexible plastic tubing that is part of a disposable tubing kit used in a blood processing system. The tubing holder 32 comprises a first or transmitter mounting block 38 into which a piezoelectric ultrasonic transmitting transducer 40 is mounted and a second or receiver mounting block 42 into which a piezoelectric ultrasonic receiving transducer 44 is mounted. The piezoelectric transducers 40, 44 provide an efficient method for electrical to ultrasonic and ultrasonic to electrical energy conversion. Ultrasound emitted by the transmitting transducer 40 is sent through the tube 34 and blood 36 and is detected by the receiving transducer 44. The tube is held between the two transducers 40, 44 by the mounting blocks 38, 42 of the tubing holder 32."

Applying Johnson et al. to Brock-Fisher would require an invasive procedure of withdrawing blood from the patient into a tube and performing the detection in the tube. This is contrary to Egozi's teaching of transmitting the electromagnetic signal into the body. Furthermore, and as previously stated, light and infrared cannot be used to excite the bubbles into resonance for detecting the second harmonic.

Therefore, based on the above explanation, the Applicant respectfully requests from the Examiner to allow dependent claims 6 and 7 under 35 U.S.C. 103(a).

Regarding dependent claims 15 and 16:

Dependent claims 15 and 16 were rejected by the Examiner under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,699,191 to Brock-Fisher in view of U.S. Patent No. 5,394,732 to Johnson et al. The Examiner states in the rejection that "regarding claim 15, Johnson teaches that the signals have different wavelengths (col. 5, lines 7 -12); and regarding claim 16, Johnson teaches that at least two of said different wavelengths have different absorption properties in blood (col. 5, lines 7 – 12 teaches infrared light and different wavelength of infrared light are known to have different absorption properties in blood)."

The Applicant respectfully disagrees with the Examiner as to the teachings of Egozi being unpatentable over Brock-Fisher in view of Johnson et al. As previously discussed regarding claims 6 and 7, the lack of mention by Brock-Fisher of the use of electromagnetic signals suggests that their teachings are not suitable for use with light or infrared (or other electromagnetic signals).

Therefore, based on the above explanation, the Applicant respectfully requests from the Examiner to allow dependent claims 15 and 16 under 35 U.S.C. 103(a).

Regarding claims 45 and 46:

The Applicant respectfully requests from the Examiner to overturn the rejections of dependent claims 45 and 46, depending from patentable independent claim 44.

Conclusion

In view of the above amendments and remarks it is respectfully submitted that claims 1 - 17, 39, 40 - 46, 49, 50, 53 – 58, 65, and 71, are now in condition for allowance. A prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,

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